Module Overview

This module explains how prepare SMAW equipment for open-root V-groove pipe welds. It also covers how to make open-root V-groove pipe welds in all positions using SMAW equipment.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Welding Level One; and Welding Level Two.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Prepare SMAW equipment for open-root V-groove pipe welds.
2. Identify and explain open-root V-groove pipe weld techniques with SMAW equipment.
3. Perform open-root V-groove pipe welds in the following positions using SMAW equipment:
   - 1G-ROTATED
   - 2G
   - 5G
   - 6G

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Prepare SMAW equipment for open-root pipe welds.
3. Make pipe welds in the 2G position.
4. Make pipe welds in the 5G position.

Materials and Equipment List

Markers/chalk
Pencils and scratch paper
Whiteboard/chalkboard
Welding 3 PowerPoint® Presentation Slides
Multimedia projector and screen
Desktop or laptop computer
Appropriate personal protective equipment
A legal safety harness with lanyards
SMAW welding equipment
A supply of 3/8” E6010 and 3/8” or ½” E7018 electrodes
Rod holder
Electrode oven
A supply of 3” to 12” diameter Schedule 40 or Schedule 80 carbon steel pipe for coupons
Cleaning materials for cleaning coupons
MSDS for each cleaning material used
Welding bench with arm for position work

Adjustable pipe stands with rollers
Portable grinders with extra grinding discs
Fully-charged fire extinguishers for the labs
Welding curtains or shields
Bevel gauges
Hi-Lo gauges
Levels
Framing squares
Soapstone
Tape measures
Precision measurement devices
(micrometers and calipers)
Pliers
Half-round bastard files
Wire brushes
Chipping hammers
Workpiece clamps
Module Examinations*
Performance Profile Sheets*

*Located in the Test Booklet.
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees will be required to set up SMAW equipment and perform open-root V-groove pipe welds. Ensure that trainees are properly briefed on the safe use of SMAW welding equipment and are familiar with all appropriate safety precautions and procedures, including electrical safety. Ensure that all labs are equipped with charged fire extinguishers.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Lincoln Electric website: http://www.lincolnelectric.com offers sources for products and training.

Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 100 hours are suggested to cover SMAW – Open-Root Pipe Welds. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of trainees may be noted during these exercises for Performance Testing purposes. The laboratory portion should take approximately 90 hours or 36 sessions.

<table>
<thead>
<tr>
<th>Topic</th>
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<tr>
<td>Session I. Introduction; Arc Welding Equipment Setup</td>
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<td>A. Introduction</td>
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<td>B. Arc Welding Equipment Setup</td>
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<tr>
<td>1. Safety Practices</td>
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<td>2. Preparing the Welding Area</td>
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<td>3. Preparing Pipe Weld Coupons</td>
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<td>4. Electrodes</td>
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<td>5. Preparing the Welding Machine</td>
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</tbody>
</table>
Session II. Laboratory and Performance Testing
A. Laboratory
   Have trainees practice setting up the welding area and SMAW equipment for open-root V-groove pipe welds. This laboratory corresponds to Performance Task 1.
B. Laboratory
   Have trainees prepare pipe coupons for open-root pipe welds.

Session III. Open-Root V-Groove Pipe Welds
A. Open-Root V-Groove Pipe Welds
   1. Open-Root Pass
   2. Pipe Groove Weld Test Positions
   3. Acceptable and Unacceptable Pipe Weld Profiles
B. SMAW of Open-Root V-Groove Welds
   1. Flat (1G-ROTATED) Position Open-Root V-Groove Pipe Welds

Sessions IV–XIII. Laboratory and Performance Testing
A. Laboratory (1 session)
   Have trainees prepare coupons and equipment for welds in the 1G-ROTATED position.
B. Laboratory (9 sessions)
   Have trainees practice making SMAW pipe welds in the 1G-ROTATED position. This laboratory corresponds to Performance Task 2.

Sessions XIV–XXI. Horizontal (2G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing
A. Horizontal (2G) Position Open-Root V-Groove Pipe Welds (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for SMAW pipe welds in the 2G position.
C. Laboratory (6 sessions)
   Have trainees practice making SMAW pipe welds in the 2G position. This laboratory corresponds to Performance Task 3.

Sessions XXII–XXX. Multiple (5G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing
A. Multiple (5G) Position Open-Root V-Groove Pipe Welds (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for SMAW pipe welds in the 5G position.
C. Laboratory (7 sessions)
   Have trainees practice making SMAW pipe welds in the 5G position. This laboratory corresponds to Performance Task 4.

Sessions XXXI–XXXIX. Multiple Inclined (6G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing
A. Multiple Inclined (6G) Position Open-Root V-Groove Pipe Welds (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for SMAW pipe welds in the 6G position.
C. Laboratory (7 sessions)
   Have trainees practice making SMAW pipe welds in the 6G position. This laboratory corresponds to Performance Task 5.
Session XXXX. Review and Testing: Performance Accreditation Tasks

A. Module Review

B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

D. Performance Accreditation Tasks – Have trainees complete PAT 1 through PAT 4, according to the acceptance criteria.
   1. Have trainees perform PAT 1, Make an Open-Root V-Groove Pipe Weld in the 1G-ROTATED Position. This task has no AWS correlation.
   2. Have trainees perform PATs 2, 3, and 4, Make Open-Root V-Groove Pipe Welds in the 2G, 5G, and 6G positions. These tasks correspond to AWS EG3.0-96: 3.3.6.1, Unit #1, SMAW, Learning Objective #10.
Module Overview

This module explains how to prepare GMAW equipment for open-root V-groove pipe welds. It also covers how to make open-root V-groove pipe welds in all positions using GMAW equipment.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Welding Level One; Welding Level Two; and Welding Level Three, Module 29301-10.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Prepare GMAW equipment for open-root V-groove pipe welds.
2. Identify and explain open-root V-groove pipe weld techniques with GMAW equipment.
3. Perform open-root V-groove pipe welds in the following positions using GMAW equipment:
   - 1G-ROTATED
   - 2G
   - 5G
   - 6G

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Set up GMAW equipment for open-root V-groove pipe welds.
3. Make GMAW open-root V-groove pipe welds in the 2G position using applicable filler metal and shielding gas.
4. Make GMAW open-root V-groove pipe welds in the 5G position using applicable filler metal and shielding gas.

Materials and Equipment List

- Markers/chalk
- Pencils and scratch paper
- Whiteboard/chalkboard
- Multimedia projector and screen
- Desktop or laptop computer
- Appropriate personal protective equipment
- Fully charged fire extinguishers for the labs
- Welding curtains or shields
- GMAW welding equipment
- Shielding gas
- Solid or composite wire
- A supply of 4” to 12” diameter Schedule 40 or Schedule 80 carbon steel pipe for coupons
- Backing materials for carbon steel pipe
- Cleaning materials for coupons
- Antispatter compound
- MSDS for each cleaning agent used and for the antispatter compound
- Welding bench with arm for position work
- Portable grinders with extra grinding discs
- Bevel gauges
- Levels
- Hi-Lo gauges
- Framing squares
- Precision measurement devices (micrometers and calipers)
- Soapstone
- Tape measures
- Pliers
- Half-round bastard files
- Wire brushes

(continued)
Chipping hammers
Workpiece clamps
Examples of the following:
- Beads created with different welding voltage and amperage settings
- Beads created with different travel speed settings and gun angles
- Welds made with different electrode extensions, stickout lengths, and standoff distances
- Broken apart or sawed apart open-root V-groove weld

Module Examinations*
Performance Profile Sheets*

*Located in the Test Booklet

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees will be required to make open-root V-groove pipe welds using GMAW equipment. Ensure that trainees are properly briefed on the safe use of GMAW welding equipment and are familiar with all appropriate safety precautions and procedures. Verify that all labs are equipped with charged fire extinguishers.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 60 hours are suggested to cover GMAW – Pipe. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of trainees may be noted during these exercises for Performance Testing purposes. The laboratory portion should take approximately 50 hours or 20 sessions.

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<tr>
<th>Topic</th>
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<td>1. Protective Clothing and Equipment</td>
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<td>C. Welding Preparation</td>
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<tr>
<td>1. Practice Pipe Weld Coupons</td>
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<td>2. The Welding Machine</td>
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<tr>
<td><strong>Session II. Laboratory and Performance Testing</strong></td>
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<tr>
<td>A. Laboratory</td>
<td>Have trainees practice setting up GMAW equipment for open-root V-groove pipe welds. This laboratory corresponds to Performance Task 1.</td>
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<tr>
<td>B. Laboratory</td>
<td>Have trainees prepare pipe coupons for open-root V-groove pipe welds.</td>
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<tr>
<td><strong>Session III. Open-Root V-Groove Pipe Welds</strong></td>
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<tr>
<td>A. Open-Root V-Groove Pipe Welds</td>
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<tr>
<td>1. GMAW Welding Techniques</td>
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<td>2. Pipe Groove Weld Test Positions</td>
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<td>3. Acceptable and Unacceptable Pipe Weld Profiles</td>
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<td>B. Practicing Open-Root V-Groove Welds</td>
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<tr>
<td>1. Flat (1G-ROTATED) Position</td>
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<tr>
<td><strong>Sessions IV–VII. Laboratory and Performance Testing</strong></td>
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<tr>
<td>A. Laboratory (1 session)</td>
<td>Have trainees prepare coupons and support equipment for pipe welds in the 1G-ROTATED position.</td>
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<tr>
<td>B. Laboratory (3 sessions)</td>
<td>Have trainees practice making GMAW open-root V-groove pipe welds in the 1G-ROTATED position using applicable filler metal and shielding gas. This laboratory corresponds to Performance Task 2.</td>
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<tr>
<td><strong>Sessions VIII–XII. Horizontal (2G) Position Open-Root V-Groove Welds; Laboratory and Performance Testing</strong></td>
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<tr>
<td>A. Horizontal (2G) Position (1 session)</td>
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<tr>
<td>B. Laboratory (1 session)</td>
<td>Have trainees prepare coupons for GMAW pipe welds in the 2G position.</td>
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<tr>
<td>C. Laboratory (3 sessions)</td>
<td>Have trainees practice making GMAW open-root V-groove pipe welds in the 2G position using applicable filler metal and shielding gas. This laboratory corresponds to Performance Task 3.</td>
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</table>
Sessions XIII–XVII. Multiple (5G) Position Open-Root V-Groove Welds; Laboratory and Performance Testing

A. Multiple (5G) Position (1 session)  
B. Laboratory (1 session)  
   Have trainees prepare coupons for GMAW pipe welds in the 5G position.  
C. Laboratory (3 sessions)  
   Have trainees practice making GMAW open-root V-groove pipe welds in the 5G position using applicable filler metal and shielding gas. This laboratory corresponds to Performance Task 4.

Sessions XVIII–XXIII. Multiple Inclined (6G) Position Open-Root V-Groove Welds; Laboratory and Performance Testing

A. Multiple Inclined (6G) Position (1 session)  
B. Laboratory (1 session)  
   Have trainees prepare coupons for GMAW pipe welds in the 6G position.  
C. Laboratory (4 sessions)  
   Have trainees practice making GMAW open-root V-groove pipe welds in the 6G position using applicable filler metal and shielding gas. This laboratory corresponds to Performance Task 5.

Session XXIV. Review and Testing; Performance Accreditation Tasks

A. Module Review  
B. Module Examination  
   1. Trainees must score 70% or higher to receive recognition from NCCER.  
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.  
C. Performance Testing  
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.  
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.  
D. Performance Accreditation Tasks  
   Have trainees complete PAT 1 through PAT 4 according to the acceptance criteria.  
   1. Have trainees perform PAT 1, Make an Open-Root V-Groove Pipe Weld in the 1G-ROTATED Position. This task has no AWS correlation.  
   2. Have trainees perform PATs 2 and 3, Make Open-Root V-Groove Pipe Welds in the 2G and 5G Positions. These task corresponds to AWS EG3.0-96: 3.3.6.2, Unit #2, GMAW, Learning Objective #11.  
   3. Have trainees perform PAT 4, Make an Open-Root V-Groove Pipe Weld in the (6G) Position. This task corresponds to AWS EG4.0-96: 3.3.6.3, Unit #3, GMAW, Learning Objective #7.
This module explains how to prepare FCAW equipment for open-root V-groove pipe welds and how to make open-root V-groove pipe welds in all positions using FCAW equipment.

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Welding Level One; Welding Level Two; and Welding Level Three, Modules 29301-10 and 29302-10.

Upon completion of this module, the trainee will be able to do the following:
1. Prepare FCAW equipment for open-root V-groove pipe welds.
2. Identify and explain open-root V-groove pipe weld techniques with FCAW equipment.
3. Perform open-root V-groove pipe welds in the following positions using FCAW equipment:
   - 1G-ROTATED
   - 2G
   - 5G
   - 6G

Under the supervision of the instructor, the trainee should be able to do the following:
1. Set up FCAW equipment for open-root V-groove pipe welds.
3. Make FCAW open-root V-groove pipe welds in the 2G position.

Materials and Equipment List

Markers/chalk
Pencils and scratch paper
Whiteboard/chalkboard
Multimedia projector and screen
Desktop or laptop computer
Appropriate personal protective equipment
Fully charged fire extinguishers for the labs
Welding curtains or shields
FCAW welding equipment
Shielding gas
Flux-cored wire
A supply of 3” to 12” diameter Schedule 40 or Schedule 80 carbon steel pipe for coupons
Cleaning materials for coupons
MSDS for each cleaning agent used
Welding bench with arm for position work
Portable grinders with extra grinding discs
Bevel gauges
Levels
Hi-Lo gauges
Framing squares
Precision measurement devices (micrometers and calipers)
Soapstone
Tape measures
Pliers
Half-round bastard files
Wire brushes
Chipping hammers
Workpiece clamps
Examples of the following:
   - Beads created with different welding voltage and amperage settings
   - Beads created with different travel speed settings and different gun angles
   - Welds made with different electrode extensions, stickout lengths, and standoff distances
   - Broken apart or sawed apart open-root V-groove weld

Module Examinations*
Performance Profile Sheets*

*Located in the Test Booklet
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees will be required to make open-root V-groove pipe welds using FCAW equipment. Ensure that trainees are properly briefed on the safe use of FCAW welding equipment and are familiar with all appropriate safety precautions and procedures. Verify that all labs are equipped with charged fire extinguishers.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.


Lincoln Electric website: http://www.lincolnelectric.com offers sources for products and training.


Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 60 hours are suggested to cover FCAW – Pipe. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of trainees may be noted during these exercises for Performance Testing purposes. The laboratory portion should take approximately 50 hours or 20 sessions.

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<td>2. The Welding Machine</td>
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Session II. Laboratory and Performance Testing

A. Laboratory
Have trainees practice setting up FCAW equipment for open-root V-groove pipe welds. This laboratory corresponds to Performance Task 1.

B. Laboratory
Have trainees prepare pipe coupons for open-root V-groove pipe welds.

Session III. Open-Root V-Groove Pipe Welds

A. Open-Root V-Groove Pipe Welds
   1. FCAW Welding Techniques
   2. Pipe Groove Weld Test Positions
   3. Acceptable and Unacceptable Pipe Weld Profiles

B. Practicing Open-Root V-Groove Welds
   1. Flat (1G-ROTATED) Position

Sessions IV–VII. Laboratory and Performance Testing

A. Laboratory (1 session)
Have trainees prepare coupons and support equipment for pipe welds in the 1G-ROTATED position.

B. Laboratory (3 sessions)
Have trainees practice making FCAW open-root V-groove pipe welds in the 1G-ROTATED position using applicable filler wire and shielding gas, if required. This laboratory corresponds to Performance Task 2.

Sessions VIII–XII. Horizontal (2G) Position Open-Root V-Groove Welds;
Laboratory and Performance Testing

A. Horizontal (2G) Position (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for FCAW pipe welds in the 2G position.

C. Laboratory (3 sessions)
   Have trainees practice making FCAW open-root V-groove pipe welds in the 2G position using applicable filler wire and shielding gas, if required. This laboratory corresponds to Performance Task 3.

Sessions XIII–XVII. Multiple (5G) Position Open-Root V-Groove Welds;
Laboratory and Performance Testing

A. Multiple (5G) Position (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for FCAW pipe welds in the 5G position.

C. Laboratory (3 sessions)
   Have trainees practice making FCAW open-root V-groove pipe welds in the 5G position using applicable filler wire and shielding gas, if required. This laboratory corresponds to Performance Task 4.

Sessions XVIII–XXIII. Multiple Inclined (6G) Position Open-Root V-Groove Welds;
Laboratory and Performance Testing

A. Multiple Inclined (6G) Position (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for FCAW pipe welds in the 6G position.

C. Laboratory (4 sessions)
   Have trainees practice making FCAW open-root V-groove pipe welds in the 6G position using applicable filler wire and shielding gas, if required. This laboratory corresponds to Performance Task 5.
Session XXIV. Review and Testing; Performance Accreditation Tasks

A. Module Review

B. Module Examination

1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing

1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

D. Performance Accreditation Tasks

Have trainees complete PAT 1 through PAT 3, according to the acceptance criteria.

1. Have trainees perform PATs 1 and 2, Make Open-Root V-Groove Pipe Welds in the 2G and 5G Positions. These tasks correspond to AWS EG3.0-96: 3.3.6.3, Unit #3, FCAW, Learning Objective #7.

2. Have trainees perform PAT 3, Make an Open-Root V-Groove Pipe Weld in the 6G Position. This task corresponds to AWS EG4.0-96: 3.3.6.4, Unit #4, FCAW, Learning Objectives #7 & #8.
Module Overview

This module explains how to prepare GTAW equipment for open-root V-groove welds on carbon steel pipe. It also covers how to make open-root V-groove welds on carbon steel pipe in all positions using GTAW equipment.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Welding Level One; Welding Level Two; and Welding Level Three, Modules 29301-10 through 29303-10.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Prepare GTAW equipment for open-root V-groove welds on carbon steel pipe.
2. Identify and explain open-root V-groove pipe weld techniques with GTAW equipment.
3. Perform open-root V-groove welds on carbon steel pipe in the following positions using GTAW equipment:
   • 2G
   • 5G
   • 6G

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Set up GTAW equipment to create open-root V-groove welds on carbon steel pipe using the appropriate filler metal and argon gas.

Materials and Equipment List

Markers/chalk
Pencils and scratch paper
Whiteboard/chalkboard
Welding 3 PowerPoint® Presentation Slides
Multimedia projector and screen
Desktop or laptop computer
Appropriate personal protective equipment
Fully charged fire extinguishers for the labs
Welding curtains or shields
GTAW welding equipment
Shielding gas
Carbon steel filler metal
A supply of 2” to 6” diameter Schedule 40 or Schedule 80 carbon steel pipe for coupons
Cleaning materials for coupons
MSDS for each cleaning agent used
Welding bench with arm for position work
Portable grinders with extra grinding discs
Bevel gauges
Levels
Hi-Lo gauges
Framing squares
Precision measurement devices
(micrometers and calipers)
Soapstone
Tape measures
Pliers
Half-round bastard files
Wire brushes
Chipping hammers
Workpiece clamps

(continued)
Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees will be required to make open-root V-groove pipe welds using GTAW equipment. Ensure that trainees are properly briefed on the safe use of GTAW welding equipment and are familiar with all appropriate safety precautions and procedures. Check to be sure that all labs are equipped with charged fire extinguishers.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

- Lincoln Electric website: http://www.lincolnelectric.com offers sources for products and training.

Examples of acceptable and unacceptable welds as follows:
- Welds resulting from different travel speeds and arc lengths
- Welds resulting from different torch work and travel angles
- Broken apart or sawed apart open-root V-groove welds showing profiles
Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 80 hours are suggested to cover GTAW – Carbon Steel Pipe. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of trainees may be noted during these exercises for Performance Testing purposes. The laboratory portion should take approximately 65 hours or 26 sessions.

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<td>B. Safety Summary</td>
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<td>1. Protective Clothing and Equipment</td>
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<td>2. Fire/Explosion Prevention</td>
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<td>3. Work Area Ventilation</td>
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<td>C. Welding Preparation</td>
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<td>1. Practice Pipe Weld Coupons</td>
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<td>2. The Welding Machine</td>
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<td>3. Filler Metals</td>
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<td>D. Gas Tungsten Arc Welding Techniques</td>
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<td>1. Torch Travel Speed and Arc Length</td>
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<td>2. Torch Angles</td>
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<td>3. Torch and Filler Metal Handling Techniques</td>
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<tr>
<td>Session II. Laboratory</td>
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<tr>
<td>A. Laboratory</td>
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<tr>
<td>Have trainees practice setting up GTAW equipment for open-root V-groove welds on carbon steel pipe using the appropriate filler metal and argon gas. This laboratory corresponds to Performance Task 1.</td>
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<td>B. Laboratory</td>
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<tr>
<td>Have trainees prepare pipe coupons for open-root V-groove pipe welds.</td>
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<td>Session III. Open-Root V-Groove Pipe Welds</td>
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<td>A. Root Pass</td>
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<td>B. Pipe Groove Weld Test Positions</td>
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<td>C. Acceptable and Unacceptable Pipe Weld Profiles</td>
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<tr>
<td>D. Practicing Open-Root V-Groove Welds</td>
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<tr>
<td>1. Flat (1G-ROTATED) Position</td>
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<td>Sessions IV–X. Laboratory and Performance Testing</td>
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<tr>
<td>A. Laboratory (1 session)</td>
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<tr>
<td>Have trainees prepare coupons and support equipment for pipe welds in the 1G-ROTATED position.</td>
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<tr>
<td>B. Laboratory (6 sessions)</td>
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<tr>
<td>Have trainees practice making GTAW open-root V-groove welds on carbon steel pipe in the 1G-ROTATED position using carbon steel filler metal and argon gas.</td>
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</table>
Sessions XI–XVII. Horizontal (2G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing
A. Horizontal (2G) Position (1 session) 
B. Laboratory (1 session) 
Have trainees prepare coupons for GTAW pipe welds in the 2G position. 
C. Laboratory (5 sessions) 
Have trainees practice making GTAW open-root V-groove welds on carbon steel pipe in the 2G position using carbon steel filler metal and argon gas. This laboratory corresponds to Performance Task 2.

Sessions XVIII–XXIV. Multiple (5G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing
A. Multiple (5G) Position (1 session) 
B. Laboratory (1 session) 
Have trainees prepare coupons for GTAW pipe welds in the 5G position. 
C. Laboratory (5 sessions) 
Have trainees practice making GTAW open-root V-groove welds on carbon steel pipe in the 5G position using carbon steel filler metal and argon gas. This laboratory corresponds to Performance Task 3.

Sessions XXV–XXXI. Multiple Inclined (6G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing
A. Multiple Inclined (6G) Position (1 session) 
B. Laboratory (1 session) 
Have trainees prepare coupons for GTAW pipe welds in the 6G position. 
C. Laboratory (5 sessions) 
Have trainees practice making GTAW open-root V-groove welds on carbon steel pipe in the 6G position using carbon steel filler metal and argon gas. This laboratory corresponds to Performance Task 4.

Session XXXII. Review and Testing; Performance Accreditation Tasks
A. Review 
B. Module Examination 
1. Trainees must score 70% or higher to receive recognition from NCCER. 
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor. 
C. Performance Testing 
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements. 
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor. 
D. Performance Accreditation Tasks 
Have trainees complete PAT 1 through PAT 3, according to the acceptance criteria. 
1. Have trainees perform PATs 1 and 2, Make Open-Root V-Groove Pipe Welds in the 2G and 5G Positions. These tasks correspond to AWS EG3.0-96: 3.3.6.4, Unit #4, GTAW, Learning Objective #14. 
2. Have trainees perform PAT 3, Make an Open-Root V-Groove Pipe Weld in the 6G Position. This task corresponds to AWS EG4.0-96: 3.3.6.5, Unit #5, GTAW, Learning Objective #10.
Module Overview

This module explains how to make open-root V-groove welds on stainless and low-alloy (or carbon) steel pipe in the 2G, 5G, and 6G positions using GTAW equipment.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Welding Level One; Welding Level Two; and Welding Level Three, Modules 29301-10 through 29304-10.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Prepare GTAW equipment to create welds with low-alloy and/or stainless steel filler metal on carbon or stainless steel pipe.
2. Identify and explain open-root V-groove pipe weld techniques with GTAW equipment.
3. Perform open-root V-groove welds on low-alloy and stainless steel pipe in the following positions using GTAW equipment:
   - 2G
   - 5G
   - 6G

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Prepare the area for GTAW.
2. Set up GTAW equipment to create welds on carbon or stainless steel pipe with the appropriate filler metal.

Materials and Equipment List

- Markers/chalk
- Pencils and scratch paper
- Whiteboard/chalkboard
- Multimedia projector and screen
- Desktop or laptop computer
- Appropriate personal protective equipment
- Fully charged fire extinguishers for the labs
- Welding curtains or shields
- GTAW welding equipment
- Shielding gas
- Low-alloy and stainless steel filler metal
- A supply of 2” to 6” diameter Schedule 10 or Schedule 40 stainless, low-alloy, or carbon steel pipe for coupons
- Cleaning materials for coupons
- MSDS for each cleaning agent used
- Backing gas
- Backup flux
- Consumable inserts
- Welding bench with arm for position work
- Portable grinders with extra grinding discs
- Bevel gauges
- Levels
- Hi-Lo gauges

(continued)
Framing squares
Precision measurement devices (micrometers and calipers)
Soapstone
Tape measures
Pliers
Half-round bastard files
Wire brushes
Chipping hammers
Workpiece clamps
Pipe sections with backing devices to install

Welds showing the results of improper heating processes on low-alloy steel
Examples of acceptable and unacceptable welds:
- Welds created with different travel speeds and arc lengths
- Welds resulting from different torch work and travel angles
- Broken apart or sawed apart open-root V-groove welds showing profiles

Module Examinations*
Performance Profile Sheets*

Safety Considerations

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees will be required to make open-root V-groove welds on low-alloy and stainless steel pipe using GTAW. Ensure that trainees are properly briefed on the safe use of GTAW welding equipment and are familiar with all appropriate safety precautions and procedures. Check to be sure that all labs are equipped with charged fire extinguishers.

Additional Resources

This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.

Lincoln Electric website: http://www.lincolnelectric.com offers sources for products and training.
Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 70 hours are suggested to cover GTAW – Low-Alloy and Stainless Steel Pipe. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of trainees may be noted during these exercises for Performance Testing purposes. The laboratory portion should take approximately 55 hours or 22 sessions.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Planned Time</th>
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<tr>
<td><strong>Session I. Introduction; Safety Summary; Root Back Side Protection; Welding Preparation</strong></td>
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<td>A. Introduction</td>
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<td>B. Safety Summary</td>
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<td>1. Protective Clothing and Equipment</td>
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<td>3. Work Area Ventilation</td>
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<td>C. Root Back Side Protection</td>
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<td>1. Backing Gas</td>
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<td>2. Backup Flux</td>
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<td>3. Consumable Inserts</td>
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<td>D. Welding Preparation</td>
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<td>3. Filler Metals</td>
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<td><strong>Session II. Laboratory</strong></td>
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<td>A. Laboratory</td>
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<tr>
<td>Have trainees prepare the area and set up GTAW equipment for open-root V-groove pipe welds on carbon or stainless steel pipe. This laboratory corresponds to Performance Tasks 1 and 2.</td>
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<td>B. Laboratory</td>
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<tr>
<td>Have trainees prepare pipe coupons for open-root V-groove pipe welds.</td>
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<td><strong>Session III. GTAW Techniques; Open-Root V-Groove Pipe Welds</strong></td>
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<td>A. GTAW Techniques</td>
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<td>D. Torch and Filler Metal Handling Techniques</td>
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<td>E. Welding Stainless Steel</td>
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<td>1. Austenitic Stainless Steels</td>
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<td>2. Martensitic Stainless Steels</td>
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<td>3. Ferritic Stainless Steels</td>
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<td>F. Welding Low-Alloy Steel</td>
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<td>1. Controlling the Heat Cycle</td>
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<td>2. Protecting the Root</td>
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<td>G. Open-Root V-Groove Pipe Welds</td>
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<td>H. Root Pass</td>
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<td>I. Pipe Groove Weld Test Positions</td>
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<td>J. Acceptable and Unacceptable Pipe Weld Profiles</td>
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</tbody>
</table>
Session IV. Laboratory
A. Laboratory
   Have trainees practice controlling GTAW travel speed, arc length, and torch angles.
B. Laboratory
   Have trainees practice torch and filler metal handling techniques on low-alloy and stainless steel coupons.

Sessions V–XIII. Practicing Open-Root V-Groove Welds in the Horizontal (2G) Position; Laboratory and Performance Testing
A. Horizontal (2G) Position (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for GTAW pipe welds in the 2G position.
C. Laboratory (7 sessions)
   Have trainees practice making GTAW open-root V-groove welds on appropriate metal pipe in the 2G position using low-alloy and stainless steel filler metal. This laboratory corresponds to Performance Task 3.

Sessions XIV–XX. Practicing Open-Root V-Groove Welds in the Multiple (5G) Position; Laboratory and Performance Testing
A. Multiple (5G) Position (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for GTAW pipe welds in the 5G position.
C. Laboratory (5 sessions)
   Have trainees practice making GTAW open-root V-groove welds on appropriate metal pipe in the 5G position using low-alloy and stainless steel filler metal. This laboratory corresponds to Performance Task 4.

Sessions XXI–XXVII. Practicing Open-Root V-Groove Welds in the Multiple Inclined (6G) Position; Laboratory and Performance Testing
A. Multiple Inclined (6G) Position (1 session)
B. Laboratory (1 session)
   Have trainees prepare coupons for GTAW pipe welds in the 6G position.
C. Laboratory (5 sessions)
   Have trainees practice making GTAW open-root V-groove welds on appropriate metal pipe in the 6G position using low-alloy and stainless steel filler metal. This laboratory corresponds to Performance Task 5.

Session XXVIII. Review and Testing; Performance Accreditation Tasks
A. Module Review
B. Module Examination
   1. Trainees must score 70% or higher to receive recognition from NCCER.
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
C. Performance Testing
   1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
   2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.
D. Performance Accreditation Tasks
   Have trainees complete PAT 1 through PAT 3, according to the acceptance criteria.
   1. Have trainees perform PATs 1 and 2, Make Open-Root V-Groove Pipe Welds in the 2G and 5G Positions. These tasks correspond to AWS EG3.0-96: 3.3.6.4, Unit #4, GTAW, Learning Objective #15.
   2. Have trainees perform PAT 3, Make an Open-Root V-Groove Pipe Weld in the 6G Position. This task corresponds to AWS EG4.0-96: 3.3.6.5, Unit #5, GTAW, Learning Objective #11 (partial).
Module Overview

This module explains how to make SMAW open-root V-groove welds on stainless steel plate and pipe in all positions.

Prerequisites

Prior to training with this module, it is recommended that the trainee shall have successfully completed the following: Core Curriculum; Welding Level One; Welding Level Two; and Welding Level Three, Modules 29301-10 through 29305-10. Module 29306-10 is not required for successful level completion, but may be included as part of this training program.

Objectives

Upon completion of this module, the trainee will be able to do the following:

1. Identify and explain stainless steel metallurgy.
2. Identify and explain the selection of electrodes for welding stainless steel.
3. Explain welding variations for stainless steel.
4. Prepare SMAW equipment for stainless steel welds.
5. Explain open-root V-groove welds on stainless steel plate.
6. Make open-root V-groove welds on stainless steel plate in the following positions using SMAW equipment and electrodes:
   - 1G
   - 2G
   - 3G
   - 4G
7. Explain open-root V-groove welds on stainless steel pipe.
8. Make open-root V-groove welds on stainless steel pipe in the following positions using SMAW equipment and electrodes:
   - 1G-ROTATED
   - 2G
   - 5G
   - 6G

Performance Tasks

Under the supervision of the instructor, the trainee should be able to do the following:

1. Prepare SMAW equipment for stainless steel welds.
2. Make open-root V-groove welds on stainless steel plate joints in the 1G position using SMAW equipment and electrodes.
3. Make open-root V-groove welds on stainless steel plate joints in the 2G position using SMAW equipment and electrodes.
4. Make open-root V-groove welds on stainless steel plate joints in the 3G position using SMAW equipment and electrodes.
5. Make open-root V-groove welds on stainless steel plate joints in the 4G position using SMAW equipment and electrodes.
7. Make open-root V-groove welds on stainless steel pipe joints in the 2G position using SMAW equipment and electrodes.
8. Make open-root V-groove welds on stainless steel pipe joints in the 5G position using SMAW equipment and electrodes.
**Materials and Equipment List**

Markers/chalk  
Pencils and scratch paper  
Whiteboard/chalkboard  
Welding 3 PowerPoint® Presentation Slides  
Multimedia projector and screen  
Desktop or laptop computer  
Appropriate personal protective equipment  
Fully charged fire extinguishers for the labs  
Welding curtains or shields  
SMAW welding equipment  
SMAW electrodes for stainless steel  
Oven for electrodes  
Heat treatment equipment  
Pipe stands with rollers  
Heat sensing devices with indicators  
A supply of 2” to 12” diameter Schedule 40 or Schedule 80 stainless or carbon steel pipe for coupons  
Cleaning materials for coupons  
MSDS for each cleaning agent used  
Back ing materials  
Stainless steel filler wire  
Stainless steel shims  
A copy of the following:  
  - *AWS A5.4:2006, Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding*  
  - *ASME Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Qualifications*  
  - Any other standards discussed  
Welding bench with arm for position work  
Portable grinders with extra grinding discs  
Bevel gauges  
Levels  
Hi-Lo gauges  
Framing squares  

**Safety Considerations**

Ensure that the trainees are equipped with appropriate personal protective equipment and know how to use it properly. Trainees will be required to make open-root V-groove welds on stainless steel plate and pipe using SMAW equipment. Ensure that trainees are properly briefed on the safe use of SMAW equipment and are familiar with all appropriate safety precautions and procedures. Check to be sure that all labs are equipped with charged fire extinguishers.
This module is intended to present thorough resources for task training. The following reference works are suggested for both instructors and motivated trainees interested in further study. These are optional materials for continued education rather than for task training.


Lincoln Electric website: http://www.lincolnelectric.com offers sources for products and training.


### Teaching Time for this Module

An outline for use in developing your lesson plan is presented below. Note that each Roman numeral in the outline equates to one session of instruction. Each session has a suggested time period of 2½ hours. This includes 10 minutes at the beginning of each session for administrative tasks and one 10-minute break during the session. Approximately 100 hours are suggested to cover *SMAW – Stainless Steel Groove Welds*. You will need to adjust the time required for hands-on activity and testing based on your class size and resources. Because laboratories often correspond to Performance Tasks, the proficiency of trainees may be noted during these exercises for Performance Testing purposes. The laboratory portion should take 67.5 hours or 27 sessions.

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<th>Topic</th>
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<td>C. Stainless Steel Electrodes</td>
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<tr>
<td>1. AWS Filler Metal Specification System</td>
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<td>2. Classification</td>
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<td>5. Electrode Selection Considerations</td>
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<td>A. Basic Welding Variations for Stainless Steel</td>
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<td>4. Welding Carbon Steels to Stainless Steels</td>
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</tbody>
</table>
B. Welding Preparations
   1. Safety Practices
   2. Preparing the Welding Area
   3. Preparing the Practice Weld Coupons
   4. Electrodes
   5. Preparing the Welding Machine

Session III. Laboratory and Performance Testing
   A. Laboratory
      Have trainees prepare SMAW equipment for stainless steel welds. This laboratory corresponds to Performance Task 1.
   B. Laboratory
      Have trainees prepare stainless steel coupons.

Session IV. Open-Root V-Groove Welds; Practicing Open-Root V-Groove Welds on Plate
   A. Open-Root V-Groove Welds
      1. Root Pass
      2. Groove Weld Positions
      3. Acceptable and Unacceptable Groove Weld Profiles
   B. Practicing Open-Root V-Groove Welds on Plate
      1. Practicing Flat (1G) Position Open-Root V-Groove Welds

Sessions V–IX. Laboratory and Performance Testing
   A. Laboratory (1 session)
      Have trainees prepare stainless steel plate coupons for SMAW welding in the 1G position.
   B. Laboratory (4 sessions)
      Have trainees make open-root V-groove welds on stainless steel plate joints in the 1G position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 2.

Sessions X–XIII. Practicing Horizontal (2G) Position Open-Root V-Groove Welds; Laboratory and Performance Testing
   A. Practicing Horizontal (2G) Position Open-Root V-Groove Welds (1 session)
   B. Laboratory (1 session)
      Have trainees prepare stainless steel plate coupons for SMAW welding in the 2G position.
   C. Laboratory (2 sessions)
      Have trainees make open-root V-groove welds on stainless steel plate joints in the 2G position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 3.

Sessions XIV–XVII. Practicing Vertical (3G) Position Open-Root V-Groove Welds; Laboratory and Performance Testing
   A. Practicing Vertical (3G) Position Open-Root V-Groove Welds (1 session)
   B. Laboratory (1 session)
      Have trainees prepare stainless steel plate coupons for SMAW welding in the 3G position.
   C. Laboratory (2 sessions)
      Have trainees make open-root V-groove welds on stainless steel plate joints in the 3G position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 4.
Sessions XVIII–XXI. Practicing Overhead (4G) Position Open-Root V-Groove Welds; Laboratory; and Performance Testing

A. Practicing Overhead (4G) Position Open-Root V-Groove Welds (1 session)
B. Laboratory (1 session)
   Have trainees prepare stainless steel plate coupons for SMAW welding in the 4G position.
C. Laboratory (2 sessions)
   Have trainees make open-root V-groove welds on stainless steel plate joints in the 4G position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 5.

Session XXII. Preparing Practice Pipe Weld Coupons; Open-Root V-Groove Pipe Welds

A. Preparing Practice Pipe Weld Coupons
   1. Requirements
   2. Cleaning Coupons
   3. Shaping and Aligning Coupons
   4. Backing Rings for Pipe Welds
B. Open-Root V-Groove Pipe Welds
   1. Root Pass
   2. Pipe Groove Weld Test Positions
   3. Acceptable and Unacceptable Pipe Weld Profiles

Sessions XXIII–XXVII. Practicing Open-Root V-Groove Welds on Pipe; Laboratory and Performance Testing

A. Practicing Open-Root V-Groove Welds on Pipe (1 session)
   1. Practicing Flat (1G-ROTATED) Position Open-Root V-Groove Pipe Welds
B. Laboratory (1 session)
   Have trainees prepare stainless steel pipe coupons for SMAW welding in the 1G-ROTATED position.
C. Laboratory (3 sessions)
   Have trainees make open-root V-groove welds on stainless steel pipe joints in the 1G-ROTATED position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 6.

Sessions XXVIII–XXXI. Practicing Horizontal (2G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing

A. Practicing Horizontal (2G) Position Open-Root V-Groove Pipe Welds (1 session)
B. Laboratory (1 session)
   Have trainees prepare stainless steel pipe coupons for SMAW welding in the 2G position.
C. Laboratory (2 sessions)
   Have trainees make open-root V-groove welds on stainless steel pipe joints in the 2G position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 7.

Sessions XXXII–XXXV. Practicing Multiple (5G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing

A. Practicing Multiple (5G) Position Open-Root V-Groove Pipe Welds (1 session)
B. Laboratory (1 session)
   Trainees prepare stainless steel pipe coupons for SMAW welding in the 5G position.
C. Laboratory (2 sessions)
   Have trainees make open-root V-groove welds on stainless steel pipe joints in the 5G position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 8.
Sessions XXXVI–XXXIX. Multiple Inclined (6G) Position Open-Root V-Groove Pipe Welds; Laboratory and Performance Testing

A. Practicing Multiple Inclined (6G) Position Open-Root V-Groove Pipe Welds
(1 session)

B. Laboratory (1 session)
Have trainees prepare stainless steel pipe coupons for SMAW welding in the 6G position.

C. Laboratory (2 sessions)
Have trainees make open-root V-groove welds on stainless steel pipe joints in the 6G position using SMAW equipment and electrodes. This laboratory corresponds to Performance Task 9.

Session XXXX. Review and Testing: Performance Accreditation Tasks

A. Module Review

B. Module Examination
1. Trainees must score 70% or higher to receive recognition from NCCER.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

C. Performance Testing
1. Trainees must perform each task to the satisfaction of the instructor to receive recognition from NCCER. If applicable, proficiency noted during laboratory exercises can be used to satisfy the Performance Testing requirements.
2. Record the testing results on Training Report Form 200, and submit the results to the Training Program Sponsor.

D. Performance Accreditation Tasks
Have trainees complete PAT 1 through PAT 5, according to the acceptance criteria.

1. Have trainees perform PAT 1, Make Open-Root V-Groove Welds on Stainless Steel Plate Joints in the Flat (1G) Position. This task corresponds to AWS EG3.0-96: 3.3.6.1, Unit #1, SMAW, Learning Objective #7.

2. Have trainees perform PAT 2, Make Open-Root V-Groove Welds on Stainless Steel Plate Joints in the Horizontal (2G) Position. This task corresponds to AWS EG3.0-96: 3.3.6.1, Unit #1, SMAW, Learning Objective #7.

3. Have trainees perform PAT 3, Make Open-Root V-Groove Welds on Stainless Steel Plate Joints in the Vertical (3G) Position. This task corresponds to AWS EG3.0-96: 3.3.6.1, Unit #1, SMAW, Learning Objective #7.

4. Have trainees perform PAT 4, Make Open-Root V-Groove Welds on Stainless Steel Plate Joints in the Overhead (4G) Position. This task corresponds to AWS EG3.0-96: 3.3.6.1, Unit #1, SMAW, Learning Objective #7.

5. Have trainees perform PAT 5, Make Open-Root V-Groove Welds on Stainless Steel Pipe in the Multiple Inclined (6G) Position. This task corresponds to AWS EG4.0-96: 3.3.6.2, Unit #2, SMAW, Learning Objective #8 (with backing).